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PATENT SPECIFICATION

DRAWINGS ATTACHED

1,131,846

1,131,846

Date of Application and filing Complete Specification: 18 April, 1966. No. 16884/66

Application made in United States of America (No. 458566) on 25 May, 1965.

Complete Specification Published: 30 October, 1968.

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Index at Acceptance:—**A4** F35; **B5** N (17Y, 22X, 22Y, 52X, 55Y, 60Y, 170, 250, 254X, 255X, 280X, 282X, 298X, 298Y, 315, 596, 598, 626, 669, 670, 674, 675, 679, 787, 788, 807).

Int. Cl.:—**A 47** l 17/00.

COMPLETE SPECIFICATION

Improvements relating to Cleaning Devices

We, NYLONGE CORPORATION, a corporation organised under the laws of the State of Ohio, United States of America, of 1294 West 70th Street, Cleveland, Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

The present invention relates to a cleaning device and is concerned with a device for wiping and drying wet or damp surfaces.

It is a common practice to wipe wet or damp surfaces with a hydrophilic sponge, as typified by the regenerated cellulose sponges which possess the desirable property of being highly hydrophilic and which rapidly absorb large amounts of water. However, when such a sponge is employed for wiping a wet surface the procedure is generally accompanied by streaking of the surface resulting from the presence of thin films of water thereon which are left by the sponge. It appears that when the sponge is drawn along the wet surface, the working face of the sponge absorbs water from the wet surface, thereby saturating the sponge face since the water from the working face does not dissipate or diffuse sufficiently rapidly into the sponge body. As a consequence, the saturated sponge face, being unable to absorb water at a sufficient rate, leaves a trail of excess water on the surface being wiped which assumes the appearance of streaks. The hydrophobic type sponges such as those formed of the synthetic organic polymeric resins are unsuitable for wiping wet surfaces since their water absorption properties are entirely inadequate.

An object of the present invention is to provide an improved device for wiping and drying wet or damp surfaces without causing or leaving streaks or extensive residues thereon, the device having high water absorption properties, and preferably flexibility, adaptability and long life. In use, the cleaning device according to the invention would be subjected to compression, referred to hereinafter as "normal compression of the cleaning device".

According to the present invention, there is provided a cleaning device comprising an absorbent sponge member having adherent to a surface thereof a compressible, resilient, open pore, porous, hydrophobic layer not exceeding a thickness of 1/4 inch, of a flexible, soft, non-abrasive, material having a porosity such as to substantially inhibit said absorbent sponge member from contacting a surface to be cleaned, when the cleaning device is in use under normal compression of the cleaning device, said hydrophobic layer conducting fluid from the surface to be cleaned to said absorbent sponge member, the interface of said hydrophobic layer and said absorbent sponge member being water permeable.

For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made by way of example to the accompanying drawing, wherein:—

Figure 1 is a perspective view of a cleaning device embodying the present invention;

Figure 2 is an enlarged fragmentary transverse sectional view thereof, and

Figure 3 is a side elevational diagram of an apparatus which may be employed in producing the present device.

Referring firstly to Figures 1 and 2 of the drawing, there is shown a preferred embodiment of cleaning device, indicated generally by the reference numeral 10. The cleaning device 10 comprises a backing member 11 having an absorbent sponge

[Price 4s. 6d.]

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structure, the backing member 11 having adherent to a surface thereof a face member 12 in the form of a layer with a thickness not exceeding 1/4 inch of a flexible, soft, compressible, resilient, three-dimensional, open pore material of a hydrophobic synthetic organic polymeric resin having the opposite faces thereof interconnected by substantially free passageways when said layer is under normal compression, the interface of said layer and said sponge structure being water permeable. The passageways which interconnect the opposite faces of the hydrophobic layer advantageously have at least parts thereof which extend freely between the opposite faces of the hydrophobic layer in a direction perpendicular to the opposite faces. Moreover the hydrophobic layer is advantageously of a porosity and thickness that at most only a small area of the absorbent sponge in normal use reaches the level of the exposed, working face of the hydrophobic layer. Advantageously, however, the interface between the layer and the sponge structure is not spaced a distance exceeding 1/32 inch from the surface to be cleaned when the cleaning device is used and is under normal manual compression.

While the hydrophobic layer is advantageously a three dimensional substantially open retiform skeletal network of integrally interconnected strands of a hydrophobic resin, it may be an open pore foam provided that it meets the above requirements. The absorbent sponge is advantageously a regenerated cellulose sponge and the hydrophobic layer is advantageously formed of polyurethane and preferably polyether polyurethane. It should be noted that strands of the skeletal network or the open pore foam may be provided with a thin resin coating in any suitable manner, such as for example with polyethylene, polyvinyl chloride or chlorosulphonated polyurethane. The hydrophobic layer is advantageously anchored or bonded to the sponge structure by partially embedding the layer in the sponge structure.

We have discovered that a cleaning device of the above nature possesses superior properties over the conventional hydrophilic sponges such as those of regenerated cellulose, and over other sponges such as those formed of the hydrophobic synthetic resins, particularly when applied to the wiping of wet or damp surfaces. With the present improved wiping device, streaking is completely obviated and an insignificant quantity of water is left on the wiped surface. Moreover, any water which is left on the wiped surface is in the form of extremely fine droplets which rapidly evaporate without leaving any streaks or unsightly or objectional residues. It is believed that the above advantages are achieved by reason of the hydrophobic open pore or retiform network of the above character preventing any substantial direct contact between the water absorbent sponge and the wiped surface, the open pore or retiform layer functioning to scrape or squeegee the water or moisture on the wiped surface by reason of the strands of hydrophobic resin which traverse the wiped surface but retain little of the squeegeed water by reason of its hydrophobic nature. However, since during the wiping action the absorbent sponge is closely spaced from the working face of the open pore or retiform skeletal layer, the water squeegeed by the retiform layer is conducted into contact with the absorbent sponge which is widely exposed to the squeegeed water so that the water is rapidly absorbed. Thus, the wiping surface of the cleaning device is always less saturated than the corresponding face of a hydrophilic sponge. It is important to note that the open pore or retiform skeletal layer should be resilient, compressible and flexible and the filaments forming the layer should be soft and non-abrasive, and that the layer be no greater than the above specified thickness to achieve the above superior operation. In addition, the open pore or retiform skeletal network advantageously has a pore size between 40 and 120 pores per linear inch (PPI).

The backing member 11 may be a block, slab or sheet of any desired configuration and may range in thickness from about 1/8 inch to 3 inches or more. While the backing member 11 is advantageously formed of regenerated cellulose sponge, preferably fibre reinforced in known manner and preferably produced by the viscose process, it may be formed of other highly absorbent sponge materials.

The face member 12 is a layer of a flexible, soft, resilient, three dimensional substantially open retiform skeletal network of integrally connected strands of a hydrophobic synthetic organic polymeric resin and is substantially free of membraneous resin and is of a thickness, as measured from the contiguous face of the backing member 11, not exceeding 1/4 inch and preferably not exceeding 1/8 inch. The face member 12 is preferably at least 1/32 inch thick and is flaccid in its undeformed state. Advantageously, the face member 12 is from 5/32 to 1/16 inch thick. The polymeric resin forming the retiform skeletal network face member 12 is advantageously a polyurethane resin and preferably a polyether polyurethane resin. The polyurethane retiform skeletal network may be produced in any known manner, for example, by the method described in United States Specification No. 3,171,820 of Volz *et al.* The retiform skeletal network advantageously

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has a porosity of between 40 and 120 PPI and preferably between 45 and 80 PPI; a density advantageously between 1 and 4 pounds per cubic foot and preferably between 1.5 and 2.5 pounds per cubic foot, and has voids constituting advantageously between 90 and 99 per cent by volume and preferably between 95 and 98 per cent. The porosity in PPI of the retiform skeletal network advantageously increases with decreasing thickness of the face member 12. For a thickness of the face member 12 of 1/32 inch the optimum porosity thereof is 100 PPI, for a thickness thereof of 1/16 inch the optimum porosity is 80 PPI and for a thickness of 1/8 inch the optimum porosity is 60 PPI.

The face member 12 is bonded to the backing member 11 so that the interface thereof is water permeable and the surface of the backing member 11 at such interface is exposed to the voids in the face member 12. The bonding is advantageously effected by embedding in the backing member 11 the strands or filaments of the retiform skeletal network at the interface of the backing member 11 and the face member 12, whereby the face member 12 is firmly anchored to the backing member 11 and there is little impediment to the flow of water through the face member to the backing member 11.

The cleaning device 10 may be produced by superimposing a layer of the retiform skeletal network upon a layer of a viscose sponge forming mass of the desired thickness, sufficient pressure being applied to the network to effect the embedment of the underface thereof into the viscose sponge forming mass, and thereafter coagulating the viscose, regenerating the cellulose therein and then purifying the resulting composite material and cutting it to the desired shapes and sizes.

Thus, for example, as seen in Figure 3 of the drawing, a layer 13 of a viscose sponge forming mass is continuously deposited at a uniform height upon a continuously advancing endless belt 14. The composition of the sponge forming mass is well known and may be, for example, that described in United States Patent Specification No. 3,048,888 of A. Shockley *et al*, or United States Patent Specification No. 2,899,704 of F. Pekarek, and may be continuously deposited upon the advancing belt 14 in the manner described in United States Patent No. 2,989,775 of F. Pekarek or in any other suitable manner. A web 16 of the desired retiform skeletal material as above set forth is drawn from a roll or other supply thereof (not shown) and extends around the periphery of and in contact with the surface of a feed roll 17 into superimposed engagement with the advancing sponge forming mass 13. The roll 17 preferably has an elastomeric friction surface and is positively driven at a peripheral speed approximately equal to the rate of advance of the belt 14. The roll 17 is vertically adjustable and is positioned to effect the desired depth of embedment of the web 16 in the sponge forming mass 13. The web carrying mass 13 is then coagulated and the cellulose therein regenerated in the known manner such as by resistance electrical heating thereof or by transporting the mass through a hot salt solution. The regenerated cellulose is then washed, purified and bleached.

The face member 12 instead of being a retiform skeletal network of the nature described in the above-mentioned United States Patent Specification No. 3,171,820, may be a layer of an open pore foam, preferably of polyurethane and having the properties and dimensions described above. The opposite faces of the open pore foam layer should be free of mebraneous resin and the layer is advantageously formed by slicing the foam along said opposite faces from a block of foam whereby the pores along said opposite faces are crosscut to fully open the pores and expose the edges of the walls thereof. The open pore foam layer advantageously has a pore size between 40 and 120 PPI and a thickness between 5/32 and 1/16 inch, the thickness preferably varying directly as the pore size as in the case of the skeletal network. The density of the foam advantageously does not exceed 2.5 pounds per cubic foot and is preferably between 1.0 and 1.5 pounds per cubic foot. The hydrophobic open pore layer is anchored to the sponge in the manner of the skeletal network, as described above.

It will be appreciated that, while there have been described and illustrated preferred embodiments of the present invention, various modifications may be made. For example, a polyester polyurethane resin, or any other polymeric resin which is soft, non-abrasive, flexible, compressible and resilient, and in which the open pore layer thereof is substantially flaccid, may be substituted for the polyether polyurethane resin. Moreover, while the cleaning device has been illustrated as of flat rectangular form with a hydrophobic open pore layer along only one face thereof, the opposite faces of the absorbent backing member may be provided with hydrophobic layers and the whole may assume other shapes.

WHAT WE CLAIM IS:—

1. A cleaning device comprising an absorbent sponge member having adherent to a surface thereof a compressible, resilient, open pore, porous, hydrophobic layer not exceeding a thickness of 1/4 inch,

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of a flexible, soft, non-abrasive, material having a porosity such as to substantially inhibit said absorbent sponge member from contacting a surface to be cleaned, when the cleaning device is in use under normal compression of the cleaning device, said hydrophobic layer conducting fluid from the surface to be cleaned to said absorbent sponge member, the interface of said hydrophobic layer and said absorbent sponge member being water permeable.

2. A cleaning device according to claim 1, wherein said porosity is in the range of from 40 to 120 pores per linear inch.

3. A cleaning device according to claim 1 or claim 2, wherein said absorbent sponge member comprises regenerated cellulose.

4. A cleaning device according to any preceding claim, wherein said hydrophobic layer material comprises polyurethane.

5. A cleaning device according to any preceding claim, wherein said hydrophobic layer comprises a three-dimensional substantially open retiform skeletal network of integrally interconnected strands of a hydrophobic polyurethane resin.

6. A cleaning device of according to claim 5, wherein said skeletal network is substantially free from membranes.

7. A cleaning device according to any preceding claim, wherein said hydrophobic layer is from 1/4 to 1/32 inch thick.

8. A cleaning device according to any one of claim 1 to 6, wherein said hydrophobic layer is from 5/32 to 1/16 inch thick.

9. A cleaning device according to claim 7 or 8, wherein said hydrophobic layer has a high porosity when the thickness thereof is low, the porosity decreasing with increasing thickness.

10. A cleaning device according to any preceding claim, wherein said hydrophobic layer is formed by slicing a block of said hydrophobic layer material so that the pores thereof along the opposite faces of said hydrophobic layer are crosscut to fully open the pores.

11. A cleaning device according to any preceding claim, wherein said hydrophobic layer is flaccid in an undeformed state.

12. A cleaning device according to any preceding claim, wherein said hydrophobic layer has voids constituting from 90 to 99% by volume thereof.

13. A cleaning device according to claim 12, wherein said hydrophobic layer has voids constituting from 95 to 98% by volume thereof.

14. A cleaning device according to any preceding claim, wherein said hydrophobic layer is partially embedded in said sponge member at the interface thereof.

15. A cleaning device substantially as hereinbefore described with reference to Figures 1 and 2 of the accompanying drawing.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1968.
Published at the Patent Office, 25 Southampton Buildings, London, W.C.2. from which copies may be obtained.

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1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.

FIG. 1.

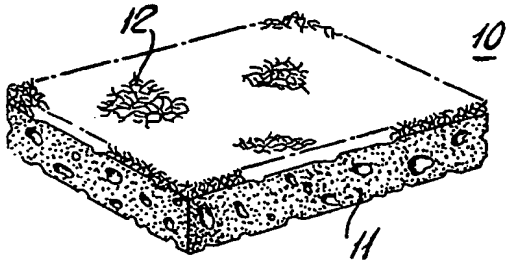


FIG. 2.

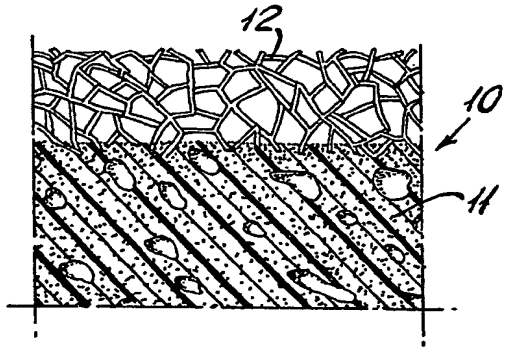
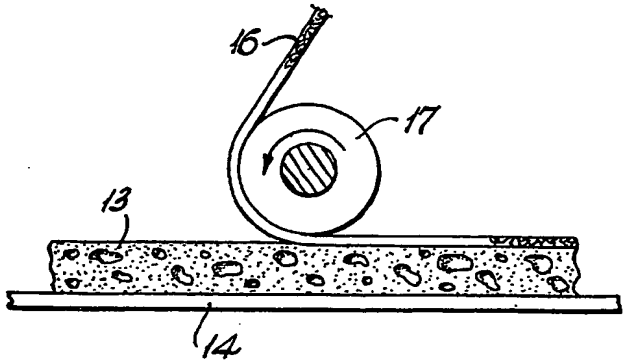


FIG. 3.



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